

# PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To:  
JOHN T. CALLAHAN  
SUGHRUE MION, PLLC  
2100 PENNSYLVANIA AVE., N.W., SUITE 800  
WASHINGTON, DC 20037-3213

## PCT

NOTIFICATION OF TRANSMITTAL OF  
THE INTERNATIONAL SEARCH REPORT AND  
THE WRITTEN OPINION OF THE INTERNATIONAL  
SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference F176322	Date of mailing (day/month/year) <b>27 OCT 2004</b>
International application No. PCT/US04/06597	International filing date (day/month/year) 05 March 2004 (05.03.2004)
Applicant UNIVERSITY OF FLORIDA REASEARCH FOUNDATION, INCORPORATED	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.  
**Filing of amendments and statement under Article 19:**  
 The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):  

**When?** The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

**Where?** Directly to the International Bureau of WIPO, 34 chemin des Colombettes  
1211 Geneva 20, Switzerland, Facsimile No.: +41 22 740 14 35

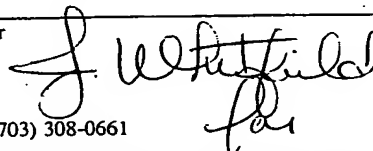
For more detailed instructions, see the notes on the accompanying sheet.
2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.
3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
  - ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.
  - ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.
4. **Reminders**  
 Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.  
 The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. These comments would also be made available to the public but not before the expiration of 30 months from the priority date.  
 Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.  
 In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.  
 See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicant's Guide*, Volume II, National Chapters and the WIPO Internet site.

Name and mailing address of the ISA/ US  
Mail Stop PCT, Attn: ISA/US  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
Facsimile No. (703) 305-3230

Authorized officer

Ivars C. Cintins

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## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference F176322	<b>FOR FURTHER ACTION</b>	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/US04/06597	International filing date ( <i>day/month/year</i> ) 05 March 2004 (05.03.2004)	(Earliest) Priority Date ( <i>day/month/year</i> ) 06 March 2003 (06.03.2003)
Applicant UNIVERSITY OF FLORIDA REASEARCH FOUNDATION, INCORPORATED		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the Report

- a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



The international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).



With regard to any nucleotide and/or amino acid sequence disclosed in the international application, see Box No. I.

2. ☐

Certain claims were found unsearchable (See Box No. II)

3. ☐

Unity of invention is lacking (See Box No. III)

4. With regard to the title,



the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

5. With regard to the abstract,



the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the drawings,

- a. the figure of the drawings to be published with the abstract is Figure No. 1



as suggested by the applicant.



as selected by this Authority, because the applicant failed to suggest a figure.



as selected by this Authority, because this figure better characterizes the invention.



none of the figures is to be published with the abstract.

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/06597

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : B01D 15/00; B01J 21/08; C02F 1/28, 1/72

US CL : 210/670, 679, 688, 748, 763, 914; 502/242, 250

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 210/670, 679, 688, 721, 748, 763, 914; 502/239, 242, 250

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ---	US 4,946,596 A (FURUTA et al.) 07 August 1990, entire document.	1-3, 8 and 9
Y		4, 5 and 11-14
X ---	US 4,786,483 A (AUDEH) 22 November 1988, col. 1, lines 51 and 54.	15, 22 and 24
Y		23
X ---	US 3,925,247 A (OGURA et al.) 09 December 1975, col. 2, lines 53, 54, 62 and 63.	15-17 and 24
Y		23
Y	US 6,013,187 A (BURNS et al.) 11 January 2000, entire document.	4, 5, 20 and 21
A, P	US 6,632,771 B1 (MAEKAWA et al.) 14 October 2003, entire document.	10 and 19

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

18 October 2004 (18.10.2004)

Date of mailing of the international search report

97 OCT 2004

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

Facsimile No. (703) 305-3230

Authorized officer

Ivars C. Cintins

Telephone No. (703) 308-0661

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL SEARCHING AUTHORITY

## PCT

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:  
JOHN T. CALLAHAN  
SUGHRUE MION, PLLC  
2100 PENNSYLVANIA AVE., N.W., SUITE 800  
WASHINGTON, DC 20037-3213

Date of mailing  
(day/month/year) 27 OCT 2004

Applicant's or agent's file reference

**FOR FURTHER ACTION**  
See paragraph 2 below

F176322

International application No.

International filing date (day/month/year)

Priority date (day/month/year)

PCT/US04/06597

05 March 2004 (05.03.2004)

06 March 2003 (06.03.2003)

International Patent Classification (IPC) or both national classification and IPC

IPC(7): B01D 15/00; B01J 21/08; C02F 1/28, 1/72 and US Cl.: 210/670, 679, 688, 748, 763, 914; 502/242, 250

Applicant

UNIVERSITY OF FLORIDA REASEARCH FOUNDATION, INCORPORATED

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

### 2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/ US

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Form PCT/ISA/237 (cover sheet) (January 2004)

**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US04/06597

**Box No. I Basis of this opinion**

1. With regard to the language, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This opinion has been established on the basis of a translation from the original language into the following language \_\_\_\_\_, which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).

2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

☐ a sequence listing

☐ table(s) related to the sequence listing

b. format of material

☐ in written format

☐ in computer readable form

c. time of filing/furnishing

☐ contained in international application as filed.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

International application No.  
PCT/US04/06597

Box No. V Reasoned statement under Rule 43 bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims <u>4-7, 10-14, 18-21 and 23</u>	YES
	Claims <u>1-3, 8, 9, 15-17, 22 and 24</u>	NO
Inventive step (IS)	Claims <u>6, 7, 10, 18 and 19</u>	YES
	Claims <u>1-5, 8, 9, 11-17 and 20-24</u>	NO
Industrial applicability (IA)	Claims <u>1-24</u>	YES
	Claims <u>NONE</u>	NO

2. Citations and explanations:

Please See Continuation Sheet

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

International application No.  
PCT/US04/06597

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

V. 2. Citations and Explanations:

Claims 1-3, 8 and 9 lack novelty under PCT Article 33(2) as being anticipated by Furuta et al. (U.S. Patent No. 4,946,596). The reference discloses adsorbing mercury from a fluid with a composite material comprising a substrate and a catalyst (see col. 3, lines 8-11 and 38-47).

Claims 15, 22 and 24 lack novelty under PCT Article 33(2) as being anticipated by Audeh (U.S. Patent No. 4,786,483). The reference discloses a composite material comprising silica and mercuric oxide (see col. 1, lines 51 and 54) in the recited proportions (see col. 3, lines 25-30).

Claims 15-17 and 24 lack novelty under PCT Article 33(2) as being anticipated by Ogura et al. (U.S. Patent No. 3,925,247). The reference discloses a composite material comprising a sorbent, a catalyst and mercuric oxide (see col. 2, lines 53, 54, 63 and 64) in the recited proportions (see col. 3, line 17).

Claims 11-14 lack an inventive step under PCT Article 33(3) as being obvious over Furuta et al. Furuta et al. discloses the claimed invention with the exception of the surface area of the composite (claim 11), the amount of catalyst present in this composite (claim 12), and the regeneration step (claims 13 and 14). However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to employ a material having the recited surface area and catalyst amount in the reference system, in order to ensure that this reference material has a sufficient amount of reaction sites. Also, it would have been obvious to regenerate this reference material with a chemical, in order to allow it to be reused.

Claim 23 lacks an inventive step under PCT Article 33(3) as being obvious over Audeh or Ogura et al. Each of the references discloses the claimed invention with the exception of the recited surface area. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to employ a material having the recited surface area in either of the reference compositions, in order to ensure that these materials have a sufficient amount of reaction sites.

Claims 4 and 5 lack an inventive step under PCT Article 33(3) as being obvious over Furuta et al. in view of Burns et al. (U.S. Patent No. 6,013,187). Furuta et al. discloses the claimed invention with the exception of the recited xerogel. Burns et al. discloses silica xerogels, and further teaches that these materials can be used to remove metal contaminants from a solution. It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the silica xerogel of Burns et al. for the silica of Furuta et al., since this secondary reference silica xerogel is capable of supporting a metal removing catalyst in substantially the same manner as the silica of the primary reference, to produce substantially the same results.

Claims 20 and 21 lack an inventive step under PCT Article 33(3) as being obvious over Audeh in view of Burns et al. Audeh discloses the claimed invention with the exception of the recited xerogel. Burns et al. discloses silica xerogels; and it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the silica xerogel of Burns et al. for the silica of Audeh, since this secondary reference silica xerogel is capable of supporting mercuric oxide in substantially the same manner as the silica of the primary reference, to produce substantially the same results.

**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

International application No.  
PCT/US04/06597

**Supplemental Box**

In case the space in any of the preceding boxes is not sufficient.

Claims 6 and 7 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest a method of the type recited wherein the composite material is irradiated.

Claim 10 meets the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest a method of the type recited wherein the catalyst comprises titanium dioxide.

Claim 18 and 19 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest a composite material of the type recited, further comprising a photocatalyst.

Claims 1-24 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.



## NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under Article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the *PCT Applicant's Guide*, a publication of WIPO.

In these Notes, "Article," "Rule" and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions, respectively.

### INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only.

#### What parts of the international application may be amended ?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Preliminary Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

**When ?** Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

#### Where not to file the amendments ?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

**How ?** Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

**The amendments must be made in the language in which the international application is to be published.**

#### What documents must/may accompany the amendments ?

##### Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

**The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.**